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# RTI AND COGNITIVE HYPOTHESIS TESTING FOR IDENTIFICATION AND INTERVENTION OF SPECIFIC LEARNING DISABILITIES

## The Best of Both Worlds

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### THE ENIGMA OF SPECIFIC LEARNING DISABILITIES: AN INTRODUCTORY ANALYSIS

Children who have specific cognitive processing strengths and deficits that lead to poor academic achievement may have a *specific learning disability* (SLD) (Hale, Kaufman, Naglieri, & Kavale, 2006). In the landmark 1975 Public Law 94-142, the U.S. Department of Education first formalized ability-achievement discrepancy in an attempt to define the essence of SLD and achieve consensus among stakeholders (e.g., Mercer, Jordan, Alsopp, & Mercer, 1996). The focus of researchers and practitioners alike was placed on discrepancy, with less consideration given to the essential SLD statutory definition that specifies *children with SLD have a deficit in the basic psychological processes that adversely affects academic achievement.*

Growing dissatisfaction with the SLD definition and discrepancy method has ignited a firestorm among seemingly polarized factions, who support either summative or formative evaluation (see Batsche, Kavale, & Kovaleski, 2006), suggesting a paradigm shift in practice is necessary (e.g., Reschly & Ysseldyke,

2002). Theoretical, political, and practical considerations are surely relevant, but serving children's needs must be our consummate priority, and this necessitates incorporating all empirically based practices in the schools, including those that represent the best of both these worlds.

The problem with SLD identification and service delivery is clear. SLD has become anything but "specific," with different practices in identification leading to an explosion in SLD prevalence (Reschly & Hosp, 2004), increasing by as much as 150% to 200% since 1997 (e.g., MacMillan, Gresham, Lopez, & Bocian, 1996; MacMillan & Speece, 1999) and representing 50% of all students receiving special education services (Kavale, Holdnack, & Mostert, 2005). Concerns over the use of traditional ability-achievement discrepancy for SLD identification are numerous, with the lack of sensitivity and specificity (see Rapid Reference 8.1) in measurement frequently leading to misclassification (e.g., MacMillan, Siperstein, & Gresham, 1996), which makes it difficult to establish appropriate intervention and remediation strategies for children who are struggling in school (e.g., Hale, Fiorello, Miller et al., 2008).

Problems with the traditional ability-achievement discrepancy set the stage for new ways of identifying and serving children with learning problems (Reschly & Hosp, 2004; VanDerHeyden, Witt, & Gilbertson, 2007), with response to intervention and/or instruction (RTI) being the leading candidate for replacing discrepancy. This change from summative standardized evaluation to ongoing formative assessments of academic achievement, currently epitomized in the RTI approach, was codified into law as a method for determining SLD eligibility in the

## Rapid Reference 8.1

### Defining Sensitivity and Specificity

If a disorder or disability is defined accurately, then we know what it is and who has it. An individual who has the disorder or disability is known as a *true positive*. If a true positive for a disorder or disability is known, then we can determine how *sensitive* and *specific* the tests are in diagnosing the condition.

*Sensitivity:* If a test is sensitive, then it will help us determine whether a child has a disorder or not; a poor score on the test could indicate a child has the disorder, whereas a good score makes the diagnosis unlikely.

*Specificity:* If a test is specific, it will help determine whether a child has a particular disorder as compared to other possible disorders. Thus, a poor score on the test could indicate a child is likely to have a particular disorder, but not any other disorders; whereas a good score makes the diagnosis unlikely.

Individuals with Disabilities Education Improvement Act (IDEA; 2004), with those unresponsive to RTI approaches considered eligible for special education services under the SLD category.

This chapter discusses the advantages of an RTI approach for serving children's needs, with some advocates arguing it should be mandated (Hale, 2006). Despite its empirical allure for ongoing monitoring of student achievement, and its humanistic appeal for serving all children in the prevention of learning problems (e.g., Fletcher & Vaughn, 2009), we argue that its use for SLD identification is fraught with methodological shortcomings *that cannot be resolved*, including the fact that there is no *true positive* in an RTI model. In other words, when a child fails to respond to intervention, practitioners can be sure of one thing: The child did not respond according to the idiosyncratic criteria chosen by the team (e.g., Reynolds & Shaywitz, 2009). These criteria are idiosyncratic because there are no mandated or mutually agreed upon RTI curricula, instructional methods, measures, or decision rules regarding response (Hale, Flanagan, & Naglieri, 2008).

There is a plethora of reasons why children do not respond to our best attempts at intervention, only one of which is SLD (Hale et al., 2006). Identifying a child as having SLD only because he or she did not respond to intervention is essentially a *diagnosis by default*—something that most researchers and practitioners can agree is not scientifically or empirically sound practice. While RTI is an appropriate and necessary model of service delivery, we argue that evaluation methods need to be comprehensive and individualized at Tier 3 in an RTI model (i.e., after standard and/or problem-solving RTI approaches were found to be ineffective or marginally effective). These evaluations must include cognitive and neuropsychological measures, and other data sources for accurate differential diagnosis of SLD and other disorders, not only for purposes of identification, but ultimately for developing more effective interventions.

Given the limitations of RTI for SLD identification first enumerated in 2004 (Hale, Naglieri, Kaufman, & Kavale), the Office of Special Education and Rehabilitative Services (OSERS) scrambled to incorporate what has been coined the *third method* for determining SLD in the final IDEA regulations published in 2006. Although the third method language was vague, many states (Zirkel & Thomas, 2009) and even recent achievement tests (e.g., Wechsler Individual Achievement Test–Third Edition [WIAT-III]; Wechsler, 2009), have interpreted this regulatory requirement to reflect an increasing awareness of, and interest in, identification of psychological and neuropsychological processing strengths and deficits as the preferred method of determining SLD (Hale, Fiorello, Miller et al., 2008).

**DON'T FORGET**

The difference between a child with low achievement (i.e., learning delay) and a child with a *specific* learning disability (i.e., learning deficit) is particularly relevant for SLD classification and service delivery. If a child has a learning *delay*, then a more intensive instructional approach can be used to help him or her, because he or she learns similarly to others, but needs more instruction to accomplish the same learning objectives. If a child has a learning *deficit*, then a more *individualized* instructional approach can be used to help him or her, because he or she learns *differently* than others, and needs instruction designed to meet his or her unique needs.

Although empirical alternatives for identifying SLD using a third method are available (and discussed in other chapters in this book), such as the Flanagan, Ortiz, Alfonso, and Mascolo's (2002, 2006) Operational Definition of SLD, and the Naglieri (1999) Discrepancy/Consistency Model, we focus on our Concordance-Discordance Model (C-DM; Hale, Fiorello, Bertin, & Sherman, 2003; Hale & Fiorello, 2004). The interested reader is referred to Hale, Flanagan, and Naglieri (2008) for a description of the similarities and differences among these empirically based third method approaches for SLD identification. The one thing all three approaches have in common is the identification of a cognitive strength, a cognitive deficit, and an achievement deficit associated with the cognitive deficit (Hale, Flanagan et al., 2008).

This chapter provides practitioners with a cursory understanding of how the C-DM fits within the Cognitive Hypothesis Testing (CHT) approach to assessment and intervention (Hale & Fiorello, 2004). The CHT approach, discussed in detail later, is basically a logical series of steps of hypothesis generation and testing about a child's difficulties (Hale & Fiorello, 2004). This model recognizes the value of RTI approaches for preventing learning problems and for addressing the educational needs of most children. But for those who do not respond, comprehensive evaluations to determine *why* they are not learning well, and *what* can be done to help them learn is important, not only for the learning and psychosocial needs of children with SLD, but for *all* children (Fiorello, Hale, Snyder, Forrest, & Teodori, 2008; Fiorello, Hale, Decker, & Coleman, 2009; Fuchs & Deshler, 2007; Hain, Hale, & Glass-Kendorski, 2009; Hale, Fiorello, Miller et al., 2008; Miller & Hale, 2008).

The Balanced Practice Model (Hale, 2006), discussed later in this chapter, encourages widespread adoption of RTI, not only to serve children's learning needs, but also to reduce referrals for comprehensive evaluation and special education services. However, the Balanced Practice Model also recognizes that children with *true* SLD have brain-based processing assets and deficits that lead to

a learning disability and that require individualized instruction designed to meet their unique needs (Hale, Fiorello, Miller et al., 2008). This Balanced Practice Model does not suggest that brain-based deficits in SLD are solely due to intrinsic factors, as disability is always the result of individual and environmental determinants, but rather it acknowledges that the interaction of individual and environmental influences is what has led to the SLD—an interaction that should be acknowledged in practice.

Truly individualized interventions cannot happen if an RTI-only approach is used for identifying SLD, because all children with learning problems—those who have learning delays and those with learning deficits—are clumped into a single heterogeneous SLD categorical model (Fiorello et al., 2009). For non-responders to RTI service delivery, we argue here that comprehensive evaluation of brain-behavior relationships using the CHT and C-DM approaches will not only lead to better identification of SLD, but also more effective interventions targeted to an individual child's needs.

## INITIAL ATTEMPTS AT DEFINING AND DETERMINING SPECIFIC LEARNING DISABILITY

In 1975, with the signing into law of P.L. 94-142, public schools were mandated to provide a Free and Appropriate Public Education (FAPE) to all students, including those with SLD. When the act was fully implemented in 1977, the U.S. Department of Education drew from the National Association of Community Health Centers (NACHC; 1968) definition:

> The term "specific learning disability" means a disorder in one or more of the psychological processes involved in understanding or in using language, spoken or written, which may manifest itself in an imperfect ability to listen, speak, read, write, spell or to do mathematical calculation. The term does not include children who have LD which are primarily the result of visual, hearing, or motor handicaps, or mental retardation, or emotional disturbance, or of environmental, cultural, or economic disadvantage (U.S. Office of Education, 1977).

**DON'T FORGET**

The idea of unexpected underachievement or discrepancy between ability and achievement was first formally noted when Barbara Bateman posited children's learning disorders were characterized by "an educationally significant discrepancy between their estimated potential and actual level of performance related to basic disorders in the learning process."

As part of the SLD definition movement, Samuel Kirk's student Barbara Bateman noted that children with SLD were not delayed learners, but rather showed an imperfect ability to learn, presumably due to processing deficits. Bateman's (1963) definition operationalized this notion:

> Children who have learning disorders are those who manifest an *educationally significant discrepancy* between their estimated potential and actual level of performance related to basic disorders in the learning process, which may or may not be accompanied by demonstrable central nervous system dysfunction, and which are not secondary to generalized mental retardation, educational or cultural deprivation, severe emotional disturbance or sensory loss.

Since its inception, the ability-achievement discrepancy model in SLD identification has come under increasing criticism as a useful or valid SLD identification method (e.g. Fletcher et al., 1998; Hale & Fiorello, 2004; Kavale et al., 2005; Vellutino, Scanlon & Lyon, 2000). Nevertheless, in response to inconsistency among SLD definitions, the U.S. Department of Education formalized the discrepancy between expected and actual achievement as the primary criterion for determining the presence of SLD (e.g., Mercer, Jordan, Alsopp, & Mercer, 1996).

A discrepancy between ability and achievement, or *unexpected underachievement*, is central to most definitions of SLD (e.g., Kavale & Forness, 1995; Lyon et al., 2001; Wiederholt, 1974). Although this approach was a laudable attempt at an empirically based approach to SLD identification, the model itself is fraught with problems (e.g., Aaron, 1997; Ceci, 1990, 1996; Siegel, 1989; Stanovich, 1988a; Sternberg & Grigorenko, 2002; Stuebing, Fletcher, & LeDoux, 2002), which are detailed below.

**Problem 1: Ability-achievement discrepancy does not discriminate well between low achievers and children with SLD.** Ability-achievement discrepancy discriminates poorly between children with SLD and those who are low achieving (e.g., Epps, Ysseldyke, & McGue, 1984; Francis, Shaywitz, Stuebing, Shaywitz, & Fletcher, 1996; Fuchs, Mathes, Fuchs, & Lipsey, 2001; Kavale, Fuchs, & Scruggs, 1994; Stanovich & Siegel, 1994; Ysseldyke, Algozzine, Shinn, & McGue, 1982). Groups of IQ-discrepant (cognitively strong and academically weak) and IQ-consistent (low cognitive and academic achievement) children often demonstrate significant overlap, suggesting that many low achievers are classified as SLD

inappropriately (e.g., Fuchs, Mock, Morgan, & Young, 2003). Alternatively, some processing deficits may lower IQ and achievement scores in children with SLD, presenting the illusion of consistent low performance, when in actuality the lower IQ reflects the average of the processing strengths and weaknesses (i.e., the Mark Penalty; Willis & Dumont, 1998).

Traditional ability-achievement discrepancy poorly distinguishes between low-IQ and high-IQ poor readers, with both groups often demonstrating similar underlying problems at the word-recognition level, yet high-IQ poor readers are more likely to be identified as having SLD (e.g. Aaron, 1997; Fletcher et al., 1994; Flowers, Meyer, Lovato, Wood, & Felton, 2001; O'Malley, Francis, Foorman, Fletcher, & Swank, 2002; Stanovich & Siegel, 1994; Stuebing et al., 2002; Stanovich, 2000, 2005).

**Problem 2: Ability-achievement discrepancy is applied inconsistently across local and state educational agencies, leading to variable classification rates and data that undermine the SLD construct.** Despite the fact that the discrepancy method has been the primary way to legally classify a student as SLD for nearly 30 years, regulations, policies, and procedures for implementing the discrepancy method have varied across states and local education agencies (e.g., Reschly & Hosp, 2004; Mastropieri & Scruggs, 2005). Districts used a variety of discrepancy procedures, including grade-level deviation, expectancy algorithms based on regression analysis, and/or standard-score differences (e.g., Berninger & Abbott, 1994; Reynolds, 1984; Reschly & Hosp, 2004). Further, practitioners working in schools were given much professional license regarding the degree to which they adhered to the district's SLD identification policy, which caused wide variability in SLD identification, even within a single district (e.g., Vaughn, Linan-Thompson, & Hickman, 2003), and low achievers were often identified as needing services even when they did not demonstrate a discrepancy (e.g., Gottlieb, Alter, Gottlieb, & Wishner, 1994; MacMillan et al., 1998). Implementation differences across districts and states undermine the SLD construct, especially as it relates to classification accuracy, access to services, and generalizability of research findings.

**Problem 3: Intelligence testing and ability-achievement discrepancy have led to overrepresentation of ethnic, cultural, linguistic, and racial minorities in special education and the**

**SLD category.** The overrepresentation of students from diverse ethnic, cultural, and linguistic backgrounds in special education is well documented (e.g., Deno, 1970; Dunn, 1968; MacMillan & Hendrick, 1993). Since the days of *Brown vs. Board of Education*, minority groups have been underserved academically and, later, overrepresented in special education. Dunn reported an alarmingly high number of students (60% to 80%) from minority or "low status backgrounds" in special education, a problem that has continued for some time (Artiles & Trent, 1994; Hosp & Reschly, 2004). Disproportionate representation of minority children in special education classes is not only related significantly to minority status, both also demographic and socio-economic variables (e.g., Finn, 1982; Hosp & Reschly, 2004; Oswald, Coutinho, Best, & Singh, 1999). The recurring theme of intelligence testing is that these tests are unfair for children of cultural, ethnic, racial, and linguistic difference (Hale & Fiorello, 2004). While an exploration of test bias and cultural loading in assessment is beyond the scope of this chapter, the overrepresentation of minorities in special education remains an important phenomenon.

**Problem 4: Use of rigid cutoff scores for establishing an ability-achievement discrepancy does not take into account profile variability, the relationship between ability and achievement measures, the standard error of measurement, and reasons for variable performance.** The discrepancy method relies on a difference between the predicted or expected "ability" of a child (e.g., IQ) and his or her underachievement (e.g., poor grades, standardized achievement test scores) (Reynolds, 1984). This model fails to identify those children who have lower IQs due to profile variability and who also have lower achievement scores (Willis & Dumont, 1998), as this pattern of cognitive strengths, weaknesses, and achievement deficits would be expected, given the SLD definition (Hale, Flanagan et al., 2008; Stuebing et al., 2002). While there are still some stalwart proponents of global IQ interpretation (e.g., Watkins, Glutting, & Lei, 2007), the methods used to support this position have been empirically challenged, with results suggesting profile analysis is required for children with SLD and other disabilities (Hale, Fiorello, Kavanagh, Holdnack, & Aloe, 2007).

Hale and colleagues (e.g., Elliott, Hale, Fiorello, Moldovan, & Dorvil, in press; Fiorello, Hale, McGrath, Ryan, & Quinn, 2001; Fiorello, Hale, & Snyder, 2006; Fiorello et al., 2007; Hale, Fiorello,

Kavanagh, Hoeppner, & Gaither, 2001; Hale et al., 2007; Hale, Fiorello, Miller et al., 2008) demonstrated that there is significant profile variability in children with ADHD, SLD, and traumatic brain injury, and that the most achievement variance is accounted for by subtests, not factors, with the least amount of variance accounted for by a global composite, such as overall IQ. They argue this profile variability and the limited achievement predictive validity precludes global IQ interpretation for most children with disabilities. Instead, careful empirically based profile analysis, based on knowledge of subtest factor loadings and substantiated through cross-battery interpretive approaches (Fiorello, Hale et al., 2009), must be accomplished for assessment and intervention purposes.

**CAUTION**

Profile variability precludes global IQ interpretation in children with SLD, and limits the predictive validity of the cognitive/intelligence test. Best practices requires careful examination of "psychological processes" based on empirical profile analysis to determine SLD, and how the processes are interfering with academic achievement, for identification and intervention purposes.

While a child might demonstrate discrepancy on one measure, he or she might not on another because of different technical characteristics of the measures, different construct coverage of the measures, or differences in administration and scoring (Hale & Fiorello, 2004). In addition, two children may have similar profiles and needs, but only a 1- or 2-point difference between them may determine who receives needed services. As such, cutoff scores are essentially arbitrary numbers (e.g., Aaron, 1997; Gresham, 2001; Siegel, 1999; Sternberg & Grigorenko, 2002), making SLD determination somewhat capricious (e.g., Reynolds, 1984).

**Problem 5: Ability-achievement discrepancy is not a model of prevention addressing which children need early intervention.** As such, it has been referred to as a "wait-to-fail" paradigm. It is not uncommon, no matter how significant the learning problem, for young children from prekindergarten through 3rd and 4th grade to demonstrate variability in IQ and achievement testing due to a wide range of expectations in the early grades. This developmentally appropriate variability does not allow for a statistical discrepancy between IQ and achievement to be demonstrated (e.g., Dombrowski, Kamphaus, &

Reynolds, 2004; Mather & Roberts, 1994). It is only after age 9 years, when achievement test content becomes increasingly more sophisticated, relies more heavily on information acquired through reading, and places demands on higher-order cognition, that children with significant learning difficulties begin to flounder (e.g., Vaughn et al., 2003).

Often, educators have found themselves frustrated by this wait-to-fail model, with their hands tied, unable to offer early intervention and remediation through special education (e.g., Vaughn & Fuchs, 2003), even though this time period is critical for remediation of basic skills (e.g., Fletcher et al., 1998; Stage, Abbott, Jenkins, & Berninger, 2003; Vellutino, Scanlon, & Lyon, 2000). A student's achievement scores have to deteriorate significantly to be large enough to suggest "disability," making identification of SLD in young children rare (e.g., Mather & Roberts, 1994).

**Problem 6: Ability-achievement discrepancy becomes a "test and place" system that takes valuable time and resources away from intervention designed to improve achievement.** Instead of prereferral intervention, the discrepancy model relies heavily on administration of IQ and achievement tests, and determining eligibility based on scores from these batteries, rather than interpretation of specific underlying psychological processes that have led to the SLD. As a result, the multidisciplinary team process places focus on eligibility rather than instruction and remediation (Lyon et al., 2001; Reschly & Hosp, 2004; VanDerHeyden et al., 2007). After a multidisciplinary team determines that a child is eligible for SLD services, he or she is *placed* in a special education system that supposedly provides an individualized education program. However, the link between actual summative test data and real-world remediation strategies is often unarticulated and generic at best, unrelated to the achievement deficit or curriculum the child is expected to learn (Reschly, 2005; Peterson & Shinn, 2002).

There is a resounding absence of a direct link between assessment and eligibility procedures and subsequent intervention, and standard achievement measures generally have poor instructional utility (Bocian, Beebe, MacMillan, & Gresham, 1999). This has led to few empirical studies that link cognitive assessment to intervention, with many opponents of standardized assessment suggesting there is no such thing as "aptitude-treatment interaction," based on research from the 1970s (e.g., Reschly & Ysseldyke, 2002). In addition, children who are placed in special education often receive

## Rapid Reference 8.2

### Ability-Achievement Discrepancy Invalid for SLD Identification

Ability-achievement discrepancy is not a valid approach for identifying and serving children with SLD because:

- It does not discriminate between children who have SLD and those who are low achievers.
- It has been applied inconsistently across states, districts, and schools, making SLD identification arbitrary and capricious.
- It leads to overidentification of minority students.
- Rigid cutoff scores are meaningless and potentially discriminatory.
- Early intervention is critical, yet young children are seldom discrepant, so they must "wait to fail" before getting needed services.
- Intelligence test results are seldom related to intervention because the focus has been on "test and place" decision making, not intervention.

"life sentences," where they are seldom declassified, with only minimal achievement gains documented (Donovan & Cross, 2002; Lyon et al., 2001), suggesting special education has not really been special in meeting the needs of children with disabilities (e.g., Detterman & Thompson, 1997; Reynolds, 1988). Rapid Reference 8.2 summarizes why the traditional ability-achievement discrepancy method is invalid for SLD identification.

## RESPONSE TO INTERVENTION FOR SERVING CHILDREN WITH SLD: PANACEA OR PREVENTION?

Given the inadequacy of discrepancy methods in identifying SLD and serving the educational needs of these children (Stanovich, 2005), many have called for the abandonment of summative intelligence testing (e.g., Siegel, 1989) in favor of ongoing formative evaluation using curriculum-based measurement (Hosp, Hosp, & Howell, 2007) and interventions that appear to have classroom relevance or ecological validity (Reschly & Ysseldyke, 2002), in a model called RTI.

Rooted in behavioral psychology (e.g., Gresham, 2004) and beliefs that disability is merely a socially constructed phenomenon (e.g., Ysseldyke, 2009), this approach tends to view learning problems as external to the child. Based on the assumption that learning problems are environmentally influenced, this

position suggests that SLD might not even exist (e.g., Ysseldyke & Marston, 2000). Furthermore, proponents of this approach believe SLD should be transformed into a generic "learning difficulty" category (Fletcher, Coulter, Reschly, & Vaughn, 2004; Stanovich, 1994), with individual cognitive or neuropsychological differences in learning or behavior considered irrelevant, inconsequential, or even unscientific (e.g., Fletcher, Francis, Morris, & Lyon, 2005; Reschly, 2005; Stanovich, 2005).

Although there is some debate over whether a standard-protocol RTI approach (e.g., O'Connor, 2000; Vaughn et al., 2003; Vellutino et al., 1996) or problem-solving RTI approach (e.g., Ikeda & Gustafson, 2002; Tilly, 2008) should be used (Fuchs & Fuchs, 2006), with the former leading to external validity, and the latter to internal validity in decision making (Fiorello et al., 2009; Hale, Fiorello, Miller et al., 2008), most advocates argue for a multitier approach, with increasing intervention intensity used to establish response (Barnett, Daly, Jones, & Lentz, 2004). The focus of most RTI advocates is on primary intervention, or preventing learning problems in children, not on remediating their problems (e.g., Shapiro, 2006). Regardless of the method used, an RTI method offers several advantages over the wait-and-fail methods that epitomized ability-achievement discrepancy (Brown-Chidsey & Steege, 2005), as suggested in Rapid Reference 8.3.

Certainly, if practitioners had to choose between testing to determine discrepancy and providing ongoing progress monitoring and intervention through an RTI approach, RTI would appear to be the (much) better choice. In fact, we have no problems with RTI as a model for serving children's learning and behavioral needs, and some of us argue it should be mandated (Hale, 2006). Given the problems with discrepancy, why not use an RTI approach to identify SLD? Despite its promise for serving the needs of many children, we must conclude RTI *can never be a valid method for SLD identification* because it is scientifically flawed as a method of disability determination (see Fiorello et al., 2009; Hale, Flanagan et al., 2008; Hale et al., in press; Rapid Reference 8.4).

Although we wrote one of the first articles to challenge the validity of RTI for SLD identification (Hale et al., 2004), there have been numerous authors who have since concurred with our arguments, and we have all concluded that best-practice models should include a comprehensive evaluation of cognitive and/or neuropsychological processes in the identification of SLD, even if RTI is utilized first (e.g., Berninger & Holdnack, 2008; Fiorello et al., 2009; Flanagan, Ortiz, Alfonso, & Dynda, 2006; Fletcher-Janzen & Reynolds, 2008; Kaufman, 2008; Kavale et al., 2005; Kavale, Kauffman, Bachmeier, & LeFever, 2008; Machek &

## Rapid Reference 8.3

### Advantages of Using an RTI Approach

| Child Need | Discrepancy Disadvantage | RTI Advantage |
|---|---|---|
| Early identification of learning problem critical for intervention efficacy | Discrepancy and SLD identification unlikely in young children | Regular progress monitoring allows earlier recognition of problem |
| Identification of learning delay versus learning deficit | Rigid cutoff criteria established for identification; higher-functioning children more likely identified as SLD | No need to recognize delay versus deficit, all treated under the same generic learning problem instructional umbrella |
| Specific learning objectives tied to curriculum | Psychologists not taught to link assessment data to intervention | Curriculum-based measurement tied to school-based competencies |
| Rights without labels | Services provided only to children identified with SLD | Identification not necessary for service delivery |
| Nondiscriminatory evaluation and service delivery in least restrictive environment | Minorities more likely to be identified; special education became *life sentence* whereby few children were reintegrated into general education | Children not segregated because of "intelligence," but served in diverse general education environment accepting of all learners |
| Determining learning characteristics and needs | Team resources spent on testing and identification; psychologist as gatekeeper | Team resources spent on early intervention and identification |
| SLD children require individualized instruction | Special education overwhelmed with poorly identified students, and generally not effective | Differentiation and increasingly intensive instruction possible |

Nelson, 2007; Mather & Gregg, 2006; Mastropieri & Scruggs, 2005; Miller & Hale, 2008; Ofiesh, 2006; Schrank, Miller, Catering, & Desrochers, 2006; Reynolds & Shaywitz, 2009; Semrud-Clikeman, 2005; Willis & Dumont, 2006; Wodrich, Spencer, & Daley, 2006).

## Rapid Reference 8.4

### Reasons RTI Alone Cannot Be Used for SLD Identification

RTI alone cannot be used for SLD identification because:

- RTI advocates cannot agree whether a standard protocol or a problem-solving RTI approach should be used.
- There is no agreed-upon curriculum, instructional methods, or measurement tools with adequate technical quality for use in an RTI model.
- RTI research has primarily focused on word reading, and methods across grades and different content areas have not been examined sufficiently.
- There is no consensus on what constitutes an empirically based approach, and whether using a single-subject design is sufficient to make any approach "empirical."
- There is no consensus on how to determine response, or lack of response, with different methods, resulting in different children being labeled as responders or nonresponders.
- There is no consensus on establishing appropriate achievement benchmarks or intervention timelines to determine the aim line slope (a critical component of determining individual responsiveness).
- There are no agreed-upon methods for teacher training or supervision methods to ensure interventions are carried out with integrity.
- There is no possible way to determine whether a child who is nonresponsive to intervention meets SLD statutory requirements.
- Failure to respond to intervention can happen for multiple reasons, only one of which is SLD.

Although problems with implementation of RTI are significant from a measurement perspective, hindering RTI's utility for SLD identification (Fuchs & Deshler, 2007; Gerber, 2005; Kavale et al., 2008; McKenzie, 2009), probably the most *catastrophic* problems are the last two points listed in Rapid Reference 8.4; that is, we can only know that a nonresponsive child did not respond to our best attempts at intervention; and we don't know *why* the child did not respond (Fiorello et al., 2009; Hale et al., 2006; Hale, Fiorello, Miller et al., 2008).

In the standard RTI protocol, all things are held constant, with regular empirically based instruction provided to all children. We know that the decision of response and nonresponse has external validity—any child who does not respond is different from a majority of the children in the classroom who do (Fiorello et al., 2009; Hale, Fiorello, & Thompson, in press; Hale & Morley, 2009)—a fact that makes this standard protocol RTI approach preferred among many researchers (Fuchs & Fuchs, 2006). In contrast, the focus of

the problem-solving approach should be internal validity (Fiorello et al., 2009; Hale et al., in press; Hale & Morley), as the curricula, instructional methods, measurement, and contingencies may be manipulated, either in isolation or in combination, in an attempt to achieve a child's response.

**CAUTION**

Despite its promise for serving the needs of many children, we must conclude that RTI can never be a valid method for SLD identification because it is scientifically flawed as a method of disability determination.

Although internal validity in a problem-solving approach is enhanced when several variables are manipulated over time in an attempt to obtain a response (which *is* effective practice), these multiple manipulations effectively eliminate the problem-solving RTI method for determining SLD, because there is no way to determine whether it was the child or one of the changes that led to nonresponse. In single-subject designs, only *one* independent variable can be manipulated; all others must be held constant if causation is to be considered (Fiorello et al., 2009; Hale, Fiorello, Miller et al., 2008; Hale & Morley, 2009). Even if one variable is manipulated, there is still no real way to determine whether the decision of response and nonresponse has any external validity, because the design is individualized for each student (e.g., Fuchs & Fuchs, 2006), thereby precluding its use for SLD and other disorder determination.

**CAUTION**

To suggest that any child who does not respond to our best attempts at intervention is SLD by default is just bad science and practice, especially if the problem-solving approach is used, because it violates the basic tenets of establishing causation in single-subject design (i.e., manipulates multiple independent variables).

Why is the lack of external validity in problem solving so problematic for SLD identification? One of the realities about science and disability determination is that we have to know what a disability *is*, not what it *isn't*. In the science of disability determination, we call this a "true positive." Once a true positive is identified, we can then determine the number of children who are correctly identified (i.e., true positives and true negatives) and those who are not correctly identified (i.e., false positives and false negatives), which helps define the sensitivity and specificity of the measures used in a diagnostic model (Reynolds, 1997).

**CAUTION**

RTI is a flawed method for SLD identification because there is no true positive in an RTI model. We know only that a child didn't respond; we do not know why he or she didn't respond.

Without definition of a true positive for a disorder, there is no way to determine the sensitivity and specificity of the measures, so any method for determining disability will be hopelessly flawed (see Reynolds, 1997; Spitzer & Wakefield, 1999. Acknowledging this problem, Gerber (2005) noted that the RTI approach suffers from the same circularity problems that discrepancy advocates had when they confused construct measurement with the actual construct itself.

These definition and measurement problems explain, in part, why studies that have tried to use RTI methods to determine SLD (e.g., responder/nonresponder status) have been unsuccessful: that different methods for determining response result in different subsets of children classified as responders or nonresponders (Barth et al., 2008; Fuchs, Fuchs, & Compton, 2004; Speece, 2005). As Fuchs and Fuchs (2006) noted, "This [unreliability of RTI diagnosis] is important because a major criticism of IQ-achievement discrepancy as a method of SLD identification has been unreliability of the diagnosis (p. 99)." In other words, using RTI for SLD classification is *unreliable* and, therefore, *invalid* because there is no *true positive* in an RTI model (Hale, Fiorello, Miller et al., 2008).

**DON'T FORGET**

RTI offers considerable advantages over past practices in serving the learning needs of many children, but it is equally clear that those who are chronically nonresponsive to increasingly intensive interventions need something different (Fuchs & Deshler, 2007), and a comprehensive evaluation should lead to more targeted interventions based on individual needs.

Obviously, there are numerous plausible explanations for nonresponse to intervention, only one of which may be SLD (Fuchs & Deshler, 2007; Hale et al., 2006; Mather & Gregg, 2006; Schrank et al., 2006). As a result, the final regulations (34 C.F.R. Parts 300 and 301; 2006) were clear in stating that "RTI is only one component of the process to identify children in need of special education and related services. Determining why a child has not responded to research-based interventions requires a comprehensive evaluation . . . . An RTI process does not replace the need for a comprehensive evaluation." We argue here that cognitive and neuropsychological assessment can provide that additional information for more accurate identification of SLD and for ultimately establishing responsiveness in those children who do not respond in an RTI model.

## ADDRESSING IDEA SLD STATUTORY AND REGULATORY REQUIREMENTS USING THE THIRD METHOD APPROACH

Discrepancy and RTI are not the only approaches for SLD identification, according to the OSERS (34 C.F.R. Parts 300 and 301; Federal Register,

2006) final IDEA regulations, as there are *three* methods for determining SLD. We will argue here that the *only* plausible approach is the third method (often referred to as a *pattern of strengths and deficits*), because it is the only one that can address the SLD statutory (i.e., definition) and regulatory (i.e., method) IDEA requirements (Hale et al., 2006).

When IDEA (2004) was passed, ability-achievement discrepancy was no longer required, and an RTI approach could be used to identify SLD, but the third method of SLD identification was presented in the final Federal Regulations (34 C.F.R. Parts 300 and 301; Federal Register, 2006), which indicates schools: "(3) May permit the use of other alternative research-based procedures for determining whether a child has a specific learning disability, as defined in §300.8(c)(10)."

Although this third method language is necessarily vague and nonspecific, to allow autonomy in implementation, it is commonly associated with a pattern of strengths and deficits model of SLD identification, an approach that has gained traction as a viable alternative to discrepancy and RTI approaches by several state boards of education (see Zirkel & Thomas, 2009).

Of the leading candidates for a strengths and deficits pattern approach, Hale, Flanagan et al. (2008) highlight similarities among their third method approaches for identification of SLD and other disorders. Unlike discrepancy and RTI approaches, these empirical methods address the statutory and regulatory IDEA SLD identification requirements through careful evaluation of cognitive and/or neuropsychological processing patterns, and the academic achievement deficits associated with these patterns (Fiorello et al., 2008; Hale, Flanagan et al., 2008; Kavale et al., 2005). As a result, they are entirely consistent with IDEA requirements for indentifying a child with SLD (34 C.F.R. Parts 300 and 301; Federal Register, 2006), but they also help determine whether the child has another disorder interfering with academic achievement, something that cannot be accomplished using discrepancy or RTI methods.

**DON'T FORGET**

The Learning Disabilities Roundtable for the U.S. Department of Education noted, "The identification of a core cognitive deficit, or a disorder in one or more psychological processes, that is predictive of an imperfect ability to learn, is a marker for a specific learning disability." Children with SLDs process information *differently* than other children, and as school practitioners, is it incumbent upon us to articulate that in meaningful ways, both for assessment and intervention purposes.

Third method pattern approaches that include formal cognitive and neuropsychological assessment make sense given the conclusions drawn by 14

professional organizations that composed the Learning Disabilities Roundtable (2002, 2004) advisory panel. They concluded "The identification of a core cognitive deficit, or a disorder in one or more of the basic psychological processes, predictive of an imperfect ability to learn, is a marker for an SLD" (p. 5; USDOE, 2002) and " . . . also acknowledges intra-individual differences as a fundamental concept of SLD" (p. 13; USDOE, 2004).

Third method pattern approaches also make empirical sense given children with brain-based disorders such as SLD and ADHD experience developmental *deficits* (see Berninger & Richards, 2002; Castellanos et al., 2002; Collins & Rourke, 2003; Fiez & Petersen, 1998; Filipek, 1999; Fine, Semrud-Clikeman, Keith, Stapleton, & Hynd, 2007; Francis et al., 1996; Geary, Hoard, & Hamsom, 1999; Hale & Fiorello, 2004; Naglieri & Bornstein, 2003; Nicholson & Fawcett, 2001; Pugh et al., 2000; Shaywitz, Lyon, & Shaywitz, 2006; Simos et al., 2005; Stein & Chowdbury, 2006; Tallal, 2006), not simply learning *delays* as RTI advocates suggest (e.g., Barnett et al., 2004). Not only is the processing strengths and deficits pattern approach recommended by many SLD researchers and stakeholders, but it is also consistent with the views of representative samples of school-based practitioners (Caterino et al., 2008; Machek & Nelson, 2010) and professional organizations such as the National Association of School Psychologists (NASP; 2007) and American Academy of School Psychology (Schrank et al., 2006; Hale et al., 2010).

**DON'T FORGET**

Neuropsychological research clearly shows that children with SLD and other high-incidence disorders have learning deficits, *not* learning delays; therefore, interventions cannot just be more intensive, they must be individualized.

Of the third method approaches, our C-DM (see Figure 8.1; Hale & Fiorello, 2004), as part of a comprehensive evaluation that includes nonresponse to intervention and other data sources (Hale, 2006), can be used to determine whether a child has SLD, other disability, or some other cause for his or her learning and behavior difficulties. Using individual assessments of standardized cognitive and achievement measures, practitioners identify cognitive strength(s), cognitive deficit(s), and an achievement deficit(s), in addition to other data sources in the C-DM approach (Hale & Fiorello). The null hypothesis that there is no difference between the cognitive strength and cognitive deficit, or the cognitive strength and achievement deficit, is tested using the relatively straightforward standard error of difference formula (SED; Anastasi & Urbina, 1997).

The C-DM approach has been advocated for use in school psychology and neuropsychology research and practice (Elliott et al., in press; Hain et al., 2009;

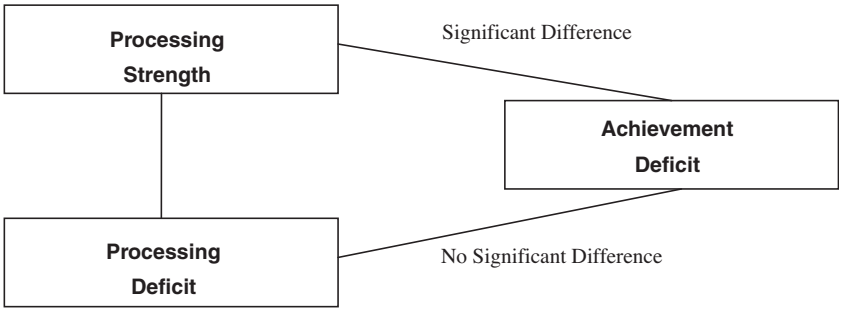


**Figure 8.1. The Concordance-Discordance Model of SLD Identification**

*Source:* After Hale & Fiorello, 2004.

Fiorello et al., 2009; Hale & Fiorello, 2004; Hale et al., 2006; Miller, Getz, & Leffard, 2006), and has been adopted in principle in modern achievement measures (e.g., WIAT-III; Wechsler et al., 2009). Hale, Fiorello, Miller et al. (2008) found that fewer children were identified with SLD using C-DM than the traditional discrepancy approach (25% who met discrepancy criteria did not show significant C-DM), so it has the potential to reduce overidentification of SLD, a concern of many in the field (e.g., Kavale et al., 2005).

**CAUTION**

The C-DM approach for SLD identification requires careful evaluation of cognitive strengths, deficits, and associated achievement deficits to ensure ecological validity of findings. It is inappropriate to just choose the highest cognitive score, the lowest cognitive score, and the lowest achievement score, and then see if they are significantly different, as this strictly numerical approach will lead to poor diagnostic and intervention decisions.

Despite the promise of a C-DM approach for advancing practice, Hale and Fiorello (2004) admonish practitioners to avoid just using the highest cognitive score, the lowest cognitive score, and the lowest achievement score, and then determine whether they are significantly different. They argue that clinical significance and ecological validity of findings must accompany statistical significance in SLD identification. It is important to examine the literature to ensure that cognitive strength is often not related to the academic deficit in question (e.g., fluid reasoning and word reading); and the cognitive deficit should be empirically associated with the academic deficit (e.g., working memory and reading comprehension).

The eight-step C-DM process provided in Rapid Reference 8.5 is designed to ensure that any child classified with SLD meets the IDEA statutory and regulatory SLD requirements (Hale, 2006). C-DM computation using the standard error of the difference formula is relatively straightforward because standard scores (SS) and reliability coefficients (often referred to as "internal consistency" or "coefficient alpha") for age level are reported in the respective cognitive and achievement manuals; and on the WIAT-III, the discordant computations are actually computed by the software.

## Rapid Reference 8.5

### Steps in the Concordance-Discordance Model of SLD Identification

| Step | Clinical Objective | Clinical Question/Decision Rules |
|---|---|---|
| 1 | Score standardized cognitive test and determine whether global composite score (e.g., IQ), factor scores, or subtest scores should be interpreted. | 1a. Are all subtest scores consistent enough to interpret global composite score (e.g., IQ)?<br>→YES, C-DM unlikely, probably not SLD; discontinue or consider other possible measure of processing deficits.<br>→NO, C-DM possible; go to Step 1b.<br>1b. If not consistent across the entire test, are the subtest scores consistent within factors to interpret factor scores?<br>→YES, C-DM possible; go to Step 2.<br>→NO, Consider subtest combinations to form new factor score within cognitive measure; go to Step 1c.<br>1c. If no subtest combinations appear to represent a new factor, can other standardized measures be added to cognitive measure to create new factor score?<br>→YES, new subtest combination appropriate for use in C-DM model; go to Step 2.<br>→NO, consider combining subsets from additional measure of at least two subtests to create new factor score for use in C-DM analyses; go to Step 2. |

| | | |
|---|---|---|
| 2 | Score standardized achievement test and examine to see if composites or subsets indicate achievement deficit. | 2a. Do standardized achievement scores indicate an academic deficit that is consistent with prior evaluation (e.g., nonresponse to intervention), classroom permanent products, and teacher-reported achievement deficits?<br>→YES, C-DM possible; go to Step 3.<br>→NO, explore other possible causes for poor test performance, or explanations for poor performance in the classroom, and consider achievement retesting to verify/refute achievement deficit; return to Step 2 or discontinue. |
| 3 | Review cognitive (e.g., CHC) and/or neuropsychological literature to ensure obtained cognitive deficit(s) is associated with achievement deficit(s). | 3a. Could obtained cognitive deficits interfere with deficient academic achievement area?<br>→YES, cognitive and/or neuropsychological deficits have been found to be related to deficit achievement area in the literature; go to Step 4.<br>→NO, C-DM unlikely unless research not conducted; check for ecological validity of cognitive and achievement deficits; return to Step 2 or discontinue. |
| 4 | Obtain reliability coefficients for cognitive strengths, cognitive deficit(s), and achievement deficit(s). | 4a. Are factor/subtest reliability coefficients (e.g., coefficient alpha) available in the cognitive and achievement technical manuals?<br>→YES, factor strengths and deficits; and achievement score reliabilities are in the manuals; go to Step 5.<br>→NO, new factor scores and reliability coefficients must be computed; average factor scores and reliability coefficients for new factors (use Fisher's z-transformation for reliabilities; see Hale et al., 2008a); go to Step 5. |
| 5 | Calculate standard error of the difference (SED) formula to establish discordance between cognitive strength and cognitive deficit. | 5a. Enter reliability coefficients for cognitive strength and deficit into SED formula, and solve for SED:<br>$SED = SD\sqrt{2 - rxx - ryy}$<br>5b. Multiply obtained SED value by 1.96 for $p < .05$, or 2.58 for $p < .01$.<br>5c. Is obtained difference between cognitive strength and deficit greater than SED critical value? |

(*continued*)

| | | |
|---|---|---|
| | | →YES, there is a significant difference between cognitive strength and deficit, so child likely has a deficit in the basic psychological processes that is interfering with academic achievement; go to Step 6.<br>→NO, consider other possible cognitive deficit responsible for achievement deficit; go to Step 1. Or the child may have another disability interfering with achievement; consider further evaluation. Or the child does not have a SLD; try to serve in intensive response-to-intervention model. |
| 6 | Calculate SED formula to establish discordance between cognitive strength and achievement deficit. | 6a. Enter reliability coefficients for cognitive strength and academic deficit into SED formula, and solve for SED:<br>$SED = SD\sqrt{2 - rxx - ryy}$<br>5b. Multiply obtained SED value by 1.96 for $p < .05$, or 2.58 for $p < .01$.<br>5c. Is obtained difference between cognitive strength and academic deficit greater than SED critical value?<br>→YES, there is a significant difference between cognitive strength and deficit, so child likely has unexpected underachievement consistent with a specific learning disability; go to Step 7.<br>→NO, consider other possible cognitive deficit and/or achievement deficit; go to Step 1. Or the child may have another disability interfering with achievement; consider further evaluation. Or discontinue; the child does not have an SLD, so try to serve in intensive RTI model. |
| 7 | Calculate SED formula to establish concordance between cognitive deficit and achievement deficit. | 6a. Enter reliability coefficients for cognitive deficit and academic deficit into SED formula, and solve for SED:<br>$SED = SD\sqrt{2 - rxx - ryy}$<br>5b. Multiply obtained SED value by 1.96 for $p < .05$, or 2.58 for $p < .01$.<br>5c. Is obtained difference between cognitive strength and academic deficit less than SED critical value?<br>→YES, there is no significant difference between cognitive deficit and the achievement deficit, thus cognitive deficit |

| | | |
|---|---|---|
| | | plausible cause for achievement deficit; consider team determination of specific learning disability classification; begin individualized instruction in inclusive or more restrictive environment as necessary; go to Step 8.<br>→NO, is the achievement deficit significantly below the cognitive deficit? If so, this could mean other factors are causing additional impairment; consider for specific learning disability classification and individualized service delivery, and additional evaluation to determine why achievement deficit is substantial; go to Step 8.<br>→NO, is the achievement deficit significantly above the cognitive deficit? If so, this could mean the child is using a compensatory strategy to score better on the academic measure, determine if results still warrant specific learning disability classification and/or individualized service delivery; go to Step 8. |
| 8 | Determine whether C-DM findings have ecological validity and achieve team consensus for SLD or other disorder determination. | Reexamine empirical literature, RTI data, teacher reports, classroom permanent products, classroom observations, and other evaluation data (including C-DM results) to determine whether child meets IDEA statutory and regulatory requirements of SLD or other disorder warranting special education services; consider within the context of other team evaluation data; consider SLD classification and service delivery in least restrictive environment. |

In many cases, the factors reported in the manual may not adequately reflect the child's cognitive profile of strengths and deficits, so new factor scores must be created using at least two subtests that measure the same construct. For instance, a child with a reading disability may show the Arithmetic, Coding, Information, Digit Span (ACID) profile, a finding common in several of our reading disability subtypes (Fiorello et al., 2006). In this case, an ACID factor score and reliability coefficient would be calculated for use in C-DM. Another possibility is a child with poor fluid reasoning (*Gf*), as measured by the WISC-IV Matrix Reasoning and Picture Concepts subtests (see Flanagan & Kaufman, 2009, for actual norms for *Gf*, based on the aforementioned subtests; Keith, Fine, Taub, Reynolds, &

Kranzler, 2006) that leads to a math word problems/reasoning achievement deficit. In this case, the new *Gf* factor score and reliability coefficient would be needed for use in the C-DM.

A case example that clearly illustrates the problems with using only the published factor scores in C-DM can be found in Hale et al. (2006). They reported the evaluation results and interventions for a child who performed within the average range on all WISC-IV Indexes, but had a significant SLD in math and written language. Although cognitive and neuropsychological testing revealed the child had a significant right hemisphere "nonverbal" LD, the factor scores were comparable because the child had a very low score on the Comprehension subtest, thereby depressing the Verbal Comprehension Index, and a very high score on Picture Concepts, thereby inflating Perceptual Reasoning, with both global scores ending up in the average range. If only the reported factor scores were analyzed using C-DM, this child's SLD would have gone undetected. To accomplish computation of these new factor scores and reliability coefficients for use in the C-DM, please see Hale, Fiorello, Miller et al. (2008).

## ENSURING DIAGNOSTIC, ECOLOGICAL, AND TREATMENT VALIDITY: THE COGNITIVE HYPOTHESIS TESTING APPROACH

Comprehensive evaluations of cognitive and neuropsychological processes are essential practice in determining whether a child has a SLD or other disorder affecting academic and behavioral functioning in the classroom (Fiorello et al., 2009; Hale, Fiorello, Miller et al., 2008), a position advocated by many accomplished scholars in the field (Berninger & Holdnack, 2008; Fiorello et al., 2009; Flanagan et al., 2006; Fletcher-Janzen & Reynolds, 2008; Kaufman, 2008; Kavale et al., 2008; Machek & Nelson, 2007; Mather & Gregg, 2006; Mastropieri & Scruggs, 2005; Miller & Hale, 2008; Ofiesh, 2006; Reynolds & Shaywitz, 2009; Schrank et al., 2006; Semrud-Clikeman, 2005; Willis & Dumont, 2006; Wodrich et al., 2006). Although comprehensive evaluations are essential practice, we realize they are costly, both in time and money, so we need to do *fewer* evaluations, but do a more thorough job when we do them. To accomplish this, Hale and Fiorello (2004) argue schools must *intervene*

**CAUTION**

When assessing any disability or disorder, finding a true positive is the only way to ensure meaningful intervention. Not only does a comprehensive evaluation ensure any child classified with SLD meets statutory and regulatory requirements, but it also ensures that a true positive can be ascertained, from which empirically based decisions can be made.

to *assess*. If RTI is done well (intervene), only those children who are nonresponders in a RTI model will need a comprehensive evaluation (assess) for SLD and other disorder determination (Fiorello et al., 2009).

Only nonresponders at Tiers 1 and 2 would be referred for comprehensive evaluations for SLD and other disorder consideration, and possible Tier 3 special education services. Standard protocol and problem-solving protocol RTI approaches are necessary (Hale, 2006), because they take into account both external and internal validity, respectively, in the decision-making process. Some RTI advocates suggest poor achievement and nonresponse is sufficient for SLD classification in an RTI model (e.g., Fletcher et al., 2005; Reschly, 2005), but a comprehensive evaluation of cognitive and neuropsychological processes is necessary, both for identification and intervention purposes at Tier 3 (e.g., Berninger & Holdnack, 2008; Fiorello et al., 2009; Flanagan et al., 2006; Fletcher-Janzen & Reynolds, 2008; Hale, Fiorello, Miller et al., 2008; Kaufman, 2008; Kavale et al., 2008; Mather & Gregg, 2006; Miller & Hale, 2008; Reynolds & Shaywitz, 2009; Schrank et al., 2006; Semrud-Clikeman, 2005; Willis & Dumont, 2006; Wodrich et al., 2006).

**DON'T FORGET**

Hale's (2006) three-tier Balanced Practice Model includes a Tier 1 standard protocol RTI approach (serving approximately 85% of children), and for nonresponders, a Tier 2 individualized problem-solving RTI (serving approximately 10% of children), both of which can happen in general education settings (Fiorello et al., 2009; Hale, 2006). Tier 3 would also include problem-solving and single-subject interventions through special education, but the comprehensive evaluation would be used to ensure accurate SLD diagnoses and targeted interventions.

The CHT model (Hale & Fiorello, 2004; see Figure 8.2) uses a scientist-practitioner approach for integrating cognitive and neuropsychological assessment and intervention for children who do not respond to standard interventions. The CHT approach and RTI share similar characteristics in that each requires ongoing data-based decision making over time, which is a problem with traditional one-time evaluations and decisions based on them (Fletcher et al., 2005). CHT uses the scientific method (theory, hypothesis testing, data collection, data interpretation) not only to establish the concurrent and ecological validity of results, but also to link this information to subsequent intervention to establish treatment efficacy. Although profile analysis is encouraged when subcomponent scores are significantly different within factors, as is the case with C-DM, the CHT model overcomes traditional profile analyses by using the intellectual/

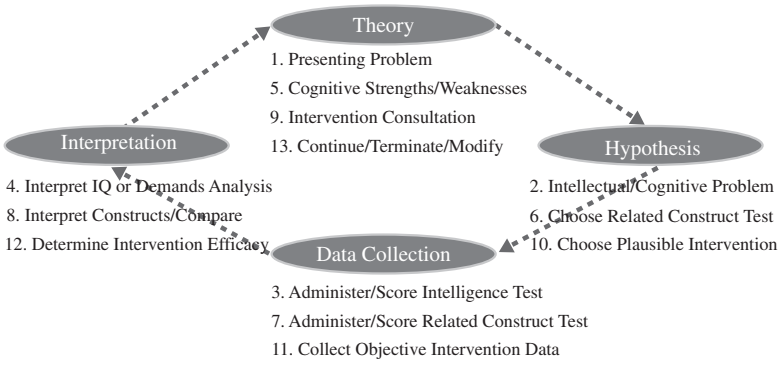


**Figure 8.2. The Cognitive Hypothesis Testing Model**

*Source:* Hale, J.B., & Fiorello, C.A. (2004). *School Neuropsychology: A Practitioner's Handbook.* New York: Guilford.

cognitive tests only as *screening* tools. Any hypotheses derived from these screening tools and other data sources (e.g., RTI, history, ratings) must be tested using other cognitive or neuropsychological measures with greater specificity, and then evaluated to ensure they have concurrent, ecological, and ultimately treatment validity (Hale & Fiorello, 2004).

Although some advocates still support a global factor/IQ interpretation (e.g., Watkins et al., 2007), which may be relevant in some cases, evidence has emerged that idiographic analysis of cognitive and neuropsychological subcomponents leads to more accurate diagnostic decision making and treatment recommendations (e.g., Hale et al., 2007; Hale, Fiorello, Miller, et al. 2008). The majority of measures available today are designed to measure multiple constructs, not IQ or a single *g* factor (Elliott et al., in press; Fiorello et al., 2001, 2007; Flanagan, Ortiz, & Alfonso, 2007; Hale et al., 2006, 2007, Hale, Fiorello, Miller, et al. 2008, Hale, Flanagan et al., 2008; McGrew & Wendling, 2010). Large-scale factor-analytic studies have provided us with Cattell-Horn-Carroll (CHC) theory, with these factors specifically linked to educational outcomes (Flanagan et al.; McGrew & Wendling).

Paralleling validation of CHC empirical findings has been a veritable explosion of neuropsychological research in reading, math, or writing disabilities, and other high-incidence disorders such as attention-deficit/hyperactivity disorder and depression (see D'Amato, Fletcher-Janzen, & Reynolds, 2005; Denckla, 2007; Feifer & Rattan, 2009; Hale & Fiorello, 2004; Miller, 2009). These neuropsychological studies are paving a fascinating empirical path that demonstrates a convergence of neuropsychological (e.g., Lurian) and cognitive-psychometric (e.g., CHC) theories, thereby providing crucial validity evidence for a synthesis of

both approaches (Fiorello et al., 2008, 2009). As researchers demonstrate the neurobiological correlates of cognitive functions (e.g., Alarcon, Pennington, Filipek, & Defries, 2000), we can use CHT methods not only to gain a greater understanding of child strengths and deficits, but also to establish a crucial foundation for ecological and treatment validity evidence of findings (Hale, Fiorello, Miller et al., 2008), something that cannot be ascertained through global IQ interpretation or nonresponse to more intensive intervention (Fiorello et al., 2009; Hale, Fiorello, Miller et al.).

One of the most egregious errors clinicians have made for decades is assuming that cognitive and neuropsychological data interpretation requires an assumption that we are measuring a stable underlying *trait* (e.g., intelligence), when in fact we are only measuring the child's *state* at the time of evaluation. Multifactorial intellectual/cognitive subtest performance varies for multiple reasons not easily identified in large group studies (Baron, 2005), but individual administration and careful clinical interpretation can identify the child's cognitive, neuropsychological, academic, and behavioral state at the time of evaluation. This is why CHT requires that any hypotheses derived from these findings be confirmed or refuted using multiple data sources, to ensure effective differential diagnoses that can lead to individualized interventions sensitive to the child's needs (Hale & Fiorello, 2004). These interventions are then developed, monitored, evaluated, and recycled until treatment efficacy is obtained (Hale & Fiorello), and single-subject case study data support the utility of such approaches (e.g., Fiorello et al., 2006; Hale et al., 2006; Reddy & Hale, 2007).

## LINKING ASSESSMENT TO INTERVENTION: MAKING CHT ASSESSMENT RESULTS RELEVANT FOR CHT INTERVENTIONS

In its infancy, neuropsychological research was primarily focused on disorder identification, and this will continue to be an important facet of research on SLD and other high-incidence disorders, especially for children who do not respond to intervention (Berninger, 2006; Hale et al., 2006; Hale, Flanagan et al., 2008; Kavale et al., 2005; Semrud-Clikeman, 2005; Willis & Dumont, 2006). However, neuropsychological research must also focus on developing effective interventions that have demonstrated ecological and treatment validity, which is the critical second half of the CHT approach to assessment and intervention (Hale & Fiorello, 2004).

CHT is designed to help practitioners address the valid criticism that cognitive and neuropsychological assessment is seldom related to intervention (e.g., Reschly, 2005), by helping practitioners use the problem-solving approach

advocated by NASP (Thomas & Grimes, 2008), to develop, implement, monitor, evaluate, and recycle interventions until treatment efficacy is achieved (Hale & Fiorello, 2004). The CHT approach has been used to document brain-behavior-intervention relationships in children with reading (Fiorello et al., 2006), math (Hale et al., 2006), and attention (Reddy & Hale, 2007) disorders, and has been advocated for use in both educational (Elliott et al., in press; Hale, Fiorello, Miller et al., 2008) and neuropsychological (Fletcher-Janzen, 2005; Miller et al., 2006) settings.

CHT intervention methods are advanced by recent neuroimaging and neuropsychological evidence that demonstrate children with SLD, attention disorders, and other psychopathologies have brain-based deficits that respond to intervention (e.g., Berninger et al., 2000; Chenault, Thomson, Abbott, & Berninger, 2006; Fiorello et al., 2006; Gustafson, Ferreira, & Ronnberg, 2007; Hale, Fiorello, & Brown, 2005; Hale et al., 2006; Helland, 2007; Lovett, Steinbach, & Frijters, 2000; Naglieri & Johnson, 2000; Shaywitz et al., 2003; Simos et al., 2005; Smit-Glaude, Van Strien, Licht, & Bakker, 2005). These neuroimaging and neuropsychological findings show that children use multiple brain areas simultaneously to complete cognitive and academic tasks (see Fiorello et al., 2009).

The deficit (not delay) model is supported by findings that suggest the brain areas typical children use to solve a task are different for those with SLD and other disabilities (see Hale, Fiorello, Miller et al., 2008); and for those with disabilities who respond to intervention, their brain functions normalize on neuropsychological and neuroimaging measures (Coch, Dawson, & Fischer, 2007; Hale et al., 2005; Richards et al., 2006; Simos et al., 2005). For a comprehensive review of the relationship between cognitive and neuropsychological processes related to reading, math, and writing, and their relevance for intervention, please see Hale, Fiorello, Miller et al. (2008) and McGrew and Wendling (2010).

## CONCLUSION

The proof is in the pudding. This chapter has documented the relevance of cognitive and neuropsychological assessment for SLD identification and intervention, but much work needs to be done to ensure these types of data are used to improve the lives of children in a meaningful way. Educating teachers and practitioners about the value of cognitive and neuropsychological assessment is one important step, but the real value added from such approaches is that these data influence intervention and result in better outcomes for children with SLD and other disabilities.

Systematic group and single-subject studies documenting treatment efficacy of cognitive and neuropsychological findings are greatly needed, and it is up to each practitioner to document the concurrent, ecological, and treatment validity of his or her assessment results with the children he or she serves. In this way, children identified with SLD will truly get the individualized services they deserve, and indeed a free, appropriate public education designed to meet their needs.

## TEST YOURSELF

1. **Children with SLD have learning delays, not learning deficits. True or False?**
2. **Intelligence tests measure only a stable underlying ability trait, not a state at the time of testing. True or False?**
3. **Neither ability-achievement discrepancy nor RTI is sufficient for determining whether a child has a specific learning disability. True or False?**
4. **There is a true positive in an RTI model, so we clearly know that a child who is nonresponsive in an RTI model is SLD. True or False?**
5. **According to the authors, the next paradigm shift will be application of neuropsychological principles and practices in the schools, often referred to as *school neuropsychology*. True or False?**
6. **Cognitive hypothesis testing is only useful for differential diagnosis of SLD and other disorders; it has nothing to do with intervention. True or False?**
7. **In cognitive hypothesis testing, the intelligence test is used as a screening tool of cognitive processes, with hypotheses derived from subtest profiles verified or refuted using additional measures. True or False?**
8. **The concordance-discordance model establishes a cognitive strength, a cognitive weakness, and an associated achievement deficit using the standard error of the difference formula. True or False?**
9. **There is no evidence that cognitive and neuropsychological processes are related to intervention. True or False?**
10. **There are studies that show changes in brain activity are associated with RTI. True or False?**

*Answers:* 1. False; 2. False; 3. True; 4. False; 5. True; 6. False; 7. True; 8. True; 9. False; 10. True.